CSCI 5409

Advanced Topics in Cloud Computing:

Report - Assignment 1

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Question 1

Summary:

Cloud computing eases the services for all types of enterprises, particularly small-scale enterprises. The main principle features of cloud computing are universal access, virtualization, fault tolerance, and low cost. There are different types of cloud service models depending upon the flexibility and control while each has its own set of benefits, namely Software as a Service (SaaS) that aims to avoid applications residing locally on users' computers, Infrastructure as a Service (IaaS) gives a wide range of virtual sources, Platform as a Service (PaaS) provides a platform to run and build applications. There are four deployment models namely public cloud which supports all users who make use of computing services across the Internet and is managed by the organization, private clouds that are better able to address the security and privacy concerns, community clouds that shares the computing resources that are a part of community, and hybrid clouds which is interconnection between the private and public cloud. The few scenarios where the applications must be avoided to migrate to cloud infrastructure are when applications need a drastic change, applications that are concerned more on licensing during migration and applications that have been developed for a long time.

SaaS is affordable and accesses the services anywhere that eliminates on-premise software. It is the best choice for small enterprises that do not have enough budget to deploy on-premise hardware. IaaS eliminates the need to deploy on-premise hardware that reduces the cost and also allows you to scale the computing resources on demand. PaaS provides all computing resources that reduce the development time and also benefits enterprises that are dispersed across various locations. SaaS is not preferred where the high performance of the application is required.

Important things that should be considered when choosing public cloud solutions are the overall cost can rise for large scale usage specifically for midsize to large enterprises, Security options that involve data breaches, insufficient identity, credential and access management, Data exposures due to misconfigurations that can lead to data breach and data theft and leads to huge loss of money, storage i.e., if the enterprise needs massive amount of storage, then they may need to consider public cloud as cheaper. Among all the public cloud service providers AWS is the largest player in the public cloud space and leading in public cloud computing. As cost is the main problem for selecting the public cloud. Many companies prefer private and hybrid clouds as they are more secure for the data.

The choice between the public, private and hybrid cloud is to be taken by the enterprises. Despite many risks associated with cloud computing; enterprises are moving their applications to the cloud. The best practices and standards need to be followed that would drastically improve the business. Proper research has to make between the convenience and security, cost and control between expansion and privacy. Finally, a great model needs to be implemented that combines risk mitigation that should serve all medium and small size organizations.

Insightful comments:

Cloud computing is the solution for every enterprise that helps them to grow dynamically as well as for the fact that it reduces all the operational costs and increasing speed, accuracy. It also allows companies to get access to data and software from anywhere. Enterprises have to choose their cloud architecture based upon their usability, depending upon their customer's accessibility of data and above all the most important thing is considering the cost and security of the data to choose between the public and private cloud.

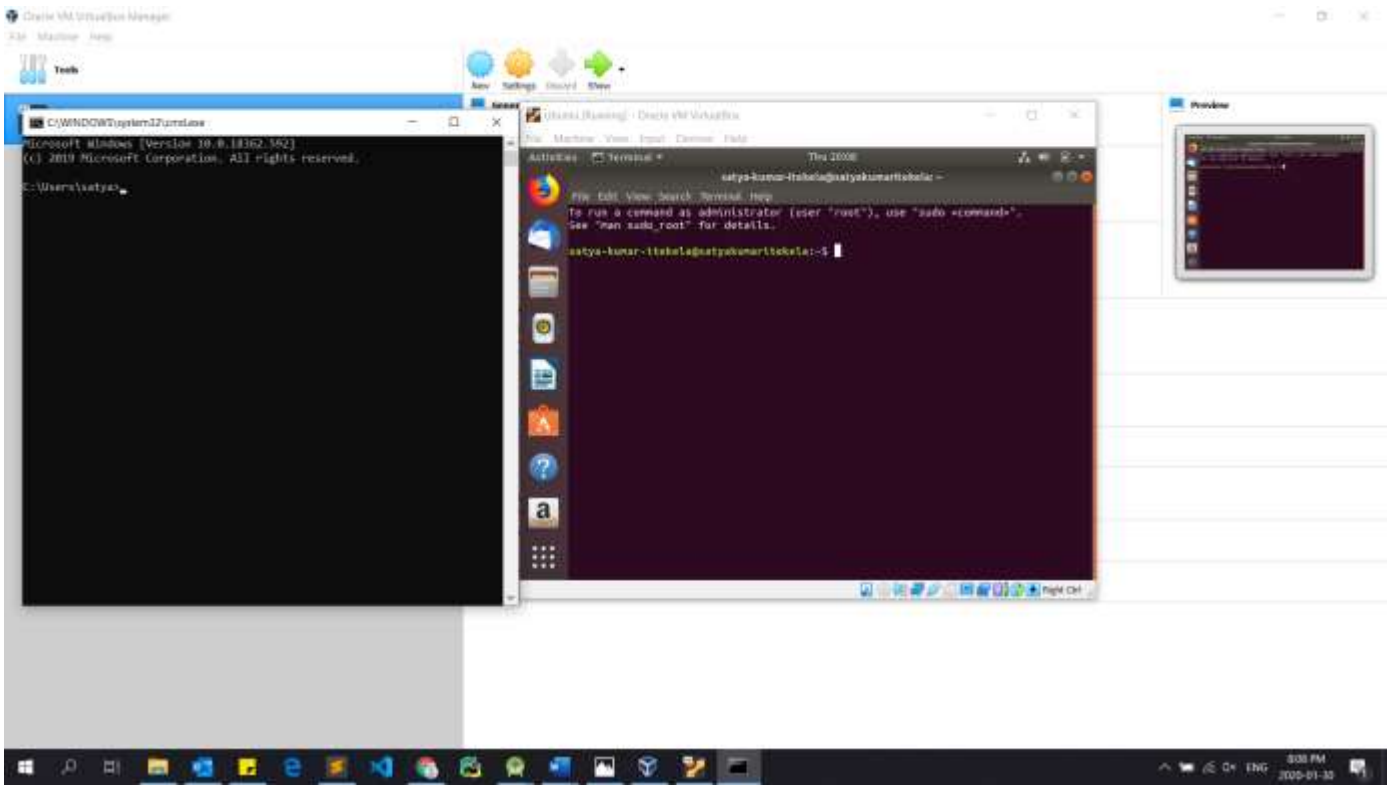
Question 2

Oracle VirtualBox

Oracle VM VirtualBox is a software virtualization application or a tool for creating, managing and running virtual machines [2]. It is a hosted hypervisor or also called as Type 2 hypervisor, which runs on that host. It helps you set up multiple virtual machines of the same operating system, or different operating systems, on a single physical machine and is also designed to run on a host operating system and can share the hardware resources offered by the host. It acts as a software layer on the top of the host operating system and the guest operating system becomes a third software level above the hardware.

The following are the main features of Oracle VM Virtual Box:

- Portability –This enables to create virtual machines created on one host can easily run on another that can be easily imported and exported using Open Virtualization Format (OVF) format [3]. It also makes use of computing and other resources for guest virtual machines through the physical host's operating system.
- Guest additions – It allows adding software packages that can be installed in guest operating systems which will improve the performance.
- Great hardware support – It can present up to 32 virtual CPUs to each virtual machine and can also support screen resolutions many times that of the physical screen.
- VM groups – It allows the users to organize and control the virtual machines collectively, as well as individually.
- Clean architecture - It is well designed with good programming interfaces and a clean separation of server and client code which makes to control multiple interfaces at once.
- Remote machine display - It also enables high-performance remote access to any running virtual machine. [4]



Question 3

a) As given in the scenario, “ABC” has 1000 users and can access the services around 1000 times in an hour. If ABC’s virtualized service is configured or designed to have access to 1 Million (1000*1000) requests in an hour, then the server could be able to handle the services else the efficiency of the system’s performance would be decreased. In order to handle the requests without delay, ABC needs to increase the computing resources, i.e., scaling up the computing resources or redesigning the computing architecture. There are two types of scaling such as horizontal scaling that would increase the servers in the resource pool and vertical scaling that would increase the computing process by increasing the computing resources such as CPU, RAM and also load balancer also could be used for this purpose. Scaling up and down is done based upon the request’s capacity. [5]

b) It is not recommended ABC company to use the private cloud, as the users use free services of the cloud. If they rent a private cloud, the price would become higher and instead, they can rent the hybrid cloud as it could also offer security and privacy concerns for the client’s private information. So, the cost also would be minimal as the users will be using the free computing resources paid by the usage and the company can store the client’s private information. It is also possible with the public cloud if ABC company implements security in the application development such as 2-factor authentication that would decrease the price even further. [5]

Question 4

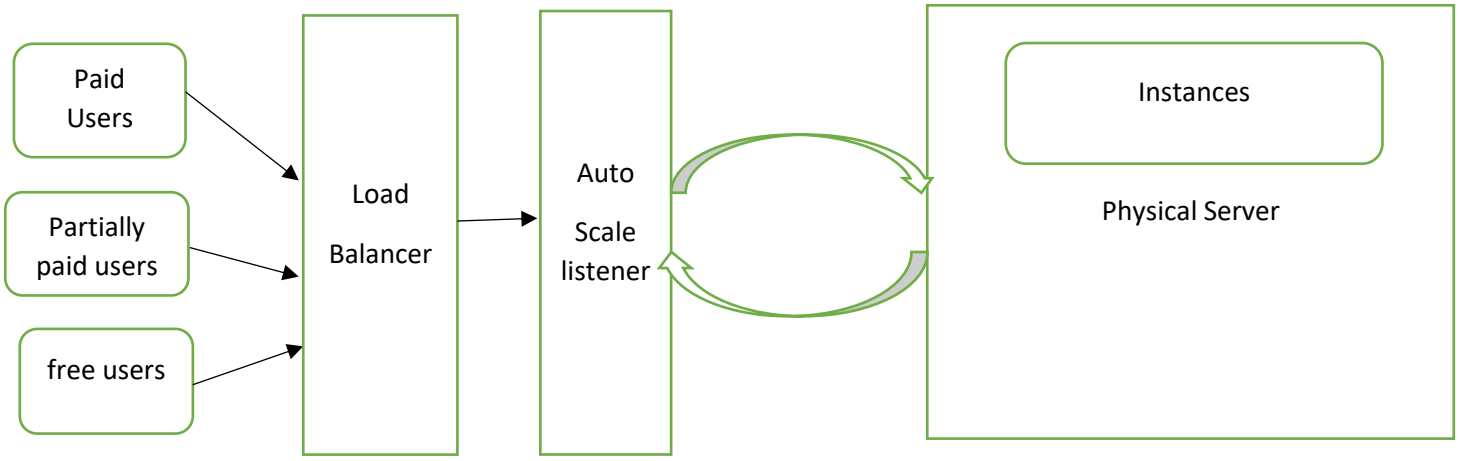
a) Cloud5409 is a cloud provider company provides cloud computing and storage services to multiple types of customers such as paid-private cloud accounts, partially paid-hybrid cloud accounts, free-public cloud accounts.

The following are the benefits that cloud5409 provides for different types of accounts:

- Paid – Can send unlimited requests, autoscaling is possible from the initial stage
- Partially paid – Can auto-scale the resources after completing the 60% task.

The architecture that I have designed have a load balancer, auto-scale listener, instances and physical server. The cloud architecture is implemented in python with the following files:

Cloudsimulate.py, loadbalance.py, resourcePool.py, task.py, virtualInstance.py, autoScaleListner.py



Step 1: The cloud service accepts multiple requests from multiple users that I have generated randomly using random function about 1000 requests. [6]

```
userStatus = ["paid_account", "partially_paid_account", "free_account"]

# count of different type of customers out of 100_000 customers
customersCount = [0.5, 0.3, 0.2]

# retrieving customer status using a random choice of total customers
customerUserStatus = choices(userStatus, customersCount)
```

Step 2: These services are collected at the load balancer and these requests are distributed to the instances and the instances are autoscaled if they are paid users and partially paid users instances are auto-scaled if the task gets completed by 60% and the free user's instances are not auto-scaled.

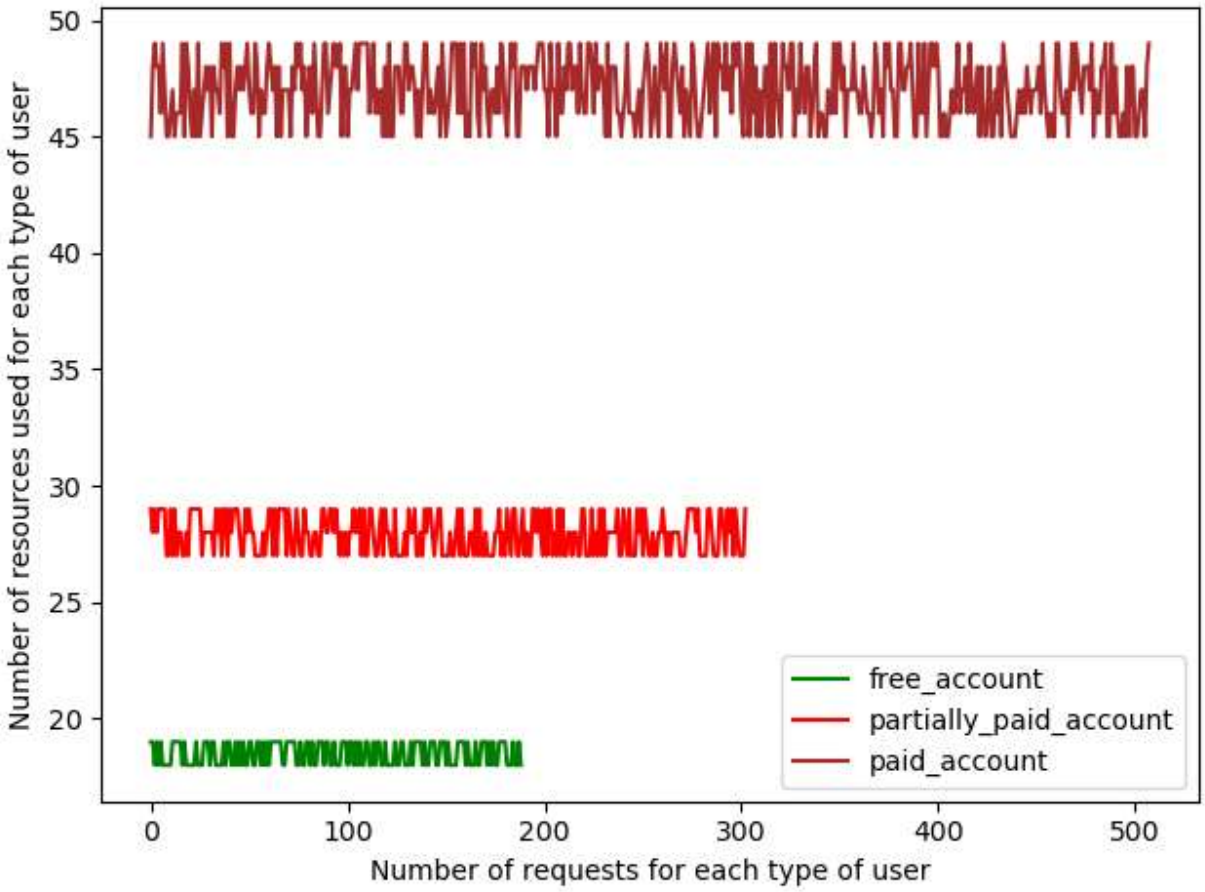
Step3: The autoscale listener checks each request whether the resources to be scaled or not and scaled based on the type of user.

Step4: Resources for the paid users, partially paid, free users are fixed and scaled according to the request.

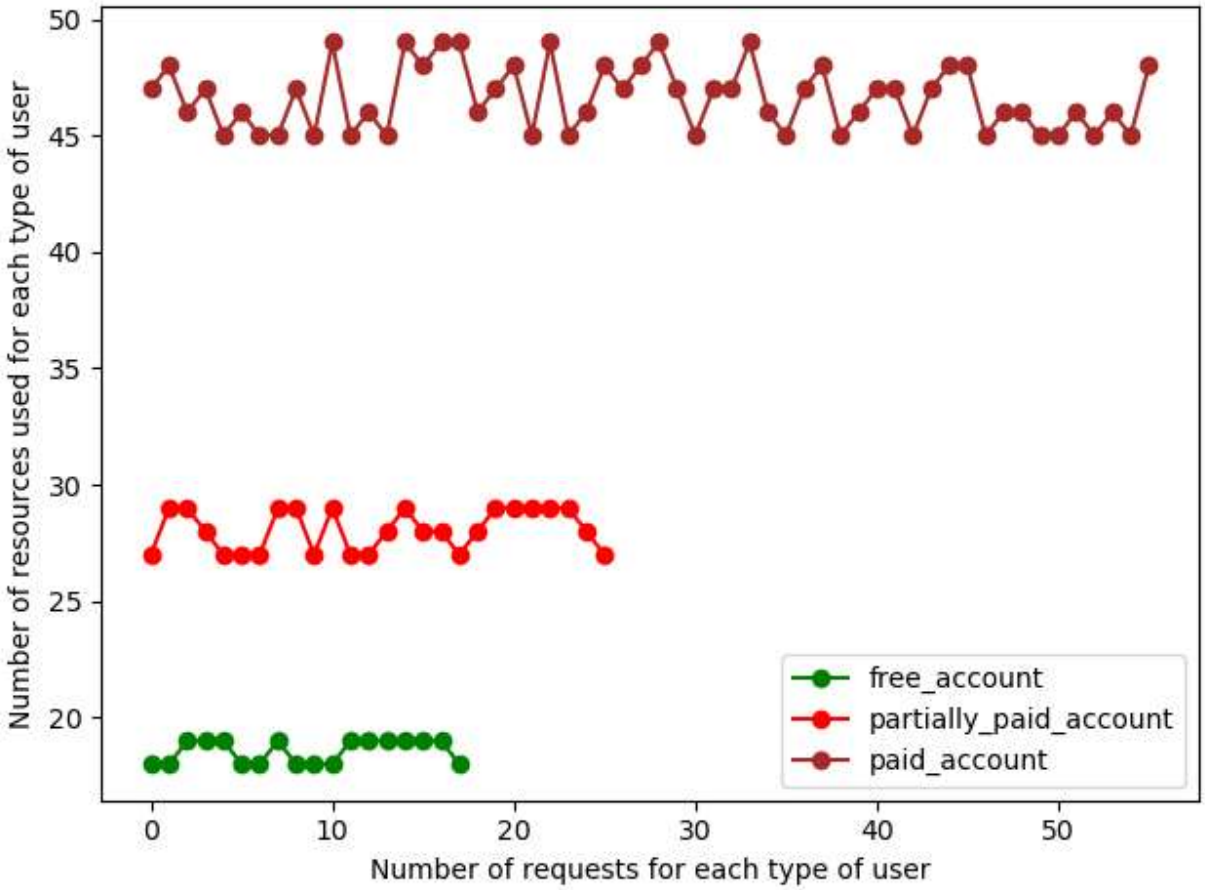
The following figure shows the resources allocated for the respective users.

c)

e) Resource usage for 1000 requests – plot the graph between the number of requests and the number of resources of each type [7]



e) Resource Usage for 100 users



References:

[1] W. Hassan, T. Chou, L. Pagliari, J. Pickard and O. Tamer, "Is Public Cloud Computing Adoption Strategically the Way to Go for All the Enterprises?," *2019 IEEE 5th Intl Conference on Big Data Security on Cloud (BigDataSecurity), IEEE Intl Conference on High Performance and Smart Computing, (HPSC) and IEEE Intl Conference on Intelligent Data and Security (IDS)*, Washington, DC, USA, 2019, pp. 310-320.

[2] "Chapter 1.First Steps", *Virtualbox.org*, 2020. [Online]. Available: https://www.virtualbox.org/manual/ch01.html#features-overview. [Accessed: 31- Jan- 2020].

[3] G. University, "Oracle VirtualBox features | Oracle VirtualBox", *Geek University*, 2020. [Online]. Available: https://geek-university.com/oracle-virtualbox/oracle-virtualbox-features/. [Accessed: 31- Jan- 2020].

[4] "How to Install Ubuntu on VirtualBox", *wikiHow*, 2020. [Online]. Available: https://www.wikihow.com/Install-Ubuntu-on-VirtualBox. [Accessed: 06- Feb- 2020].

[5] "Scalability in the cloud", *Stratoscale.com*, 2020. [Online]. Available: https://www.stratoscale.com/blog/cloud/scalability-cloud-organizations-win-cloud/. [Accessed: 06- Feb- 2020].

[6] "Python Get Random Float Numbers using random and Uniform functions", *PYnative*, 2020. [Online]. Available: https://pynative.com/python-get-random-float-numbers/. [Accessed: 06- Feb- 2020].

[7]"Graph Plotting in Python | Set 1 - GeeksforGeeks", *GeeksforGeeks*, 2020. [Online]. Available: https://www.geeksforgeeks.org/graph-plotting-in-python-set-1/. [Accessed: 06- Feb- 2020].